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(54) Painting small details on an article and cleaning paint nozzles

(57) A device for painting small details on an article includes a nozzle (7) having a work-contacting surface (9), an inlet port (5) adapted to receive a pressurised supply of paint, and a paint conduit (8) extending to the work-contacting surface 9. A valve (10) is interposed in the conduit (8) to control the flow of paint to the work-contacting surface (9) and an actuator (16) is provided for operating the valve. The nozzle may be cleaned by a rotatable brush which, in use, is partially immersed in cleaning fluid contained in a reservoir.

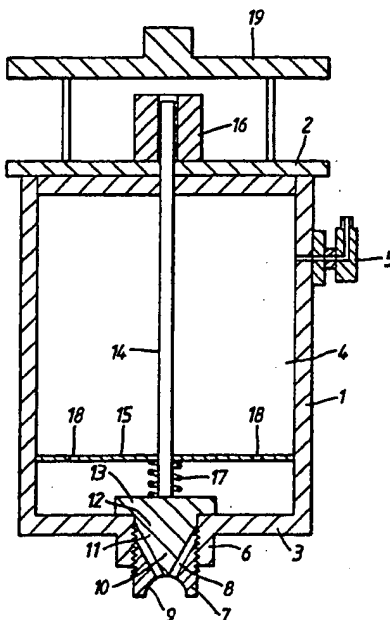


Fig. 1.

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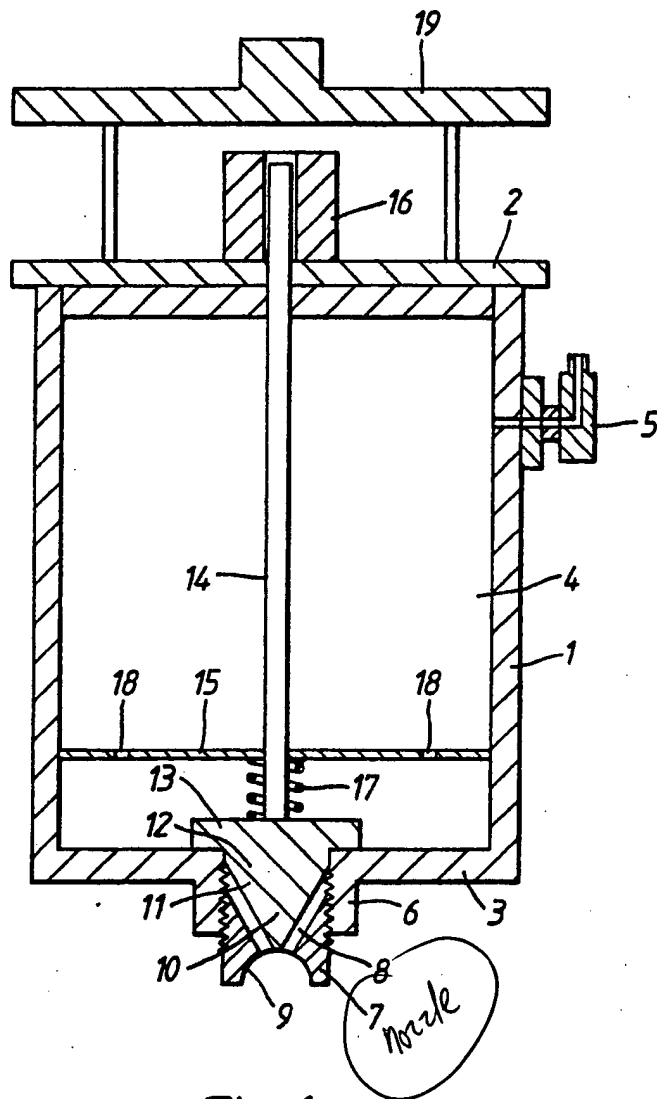


Fig. 1.

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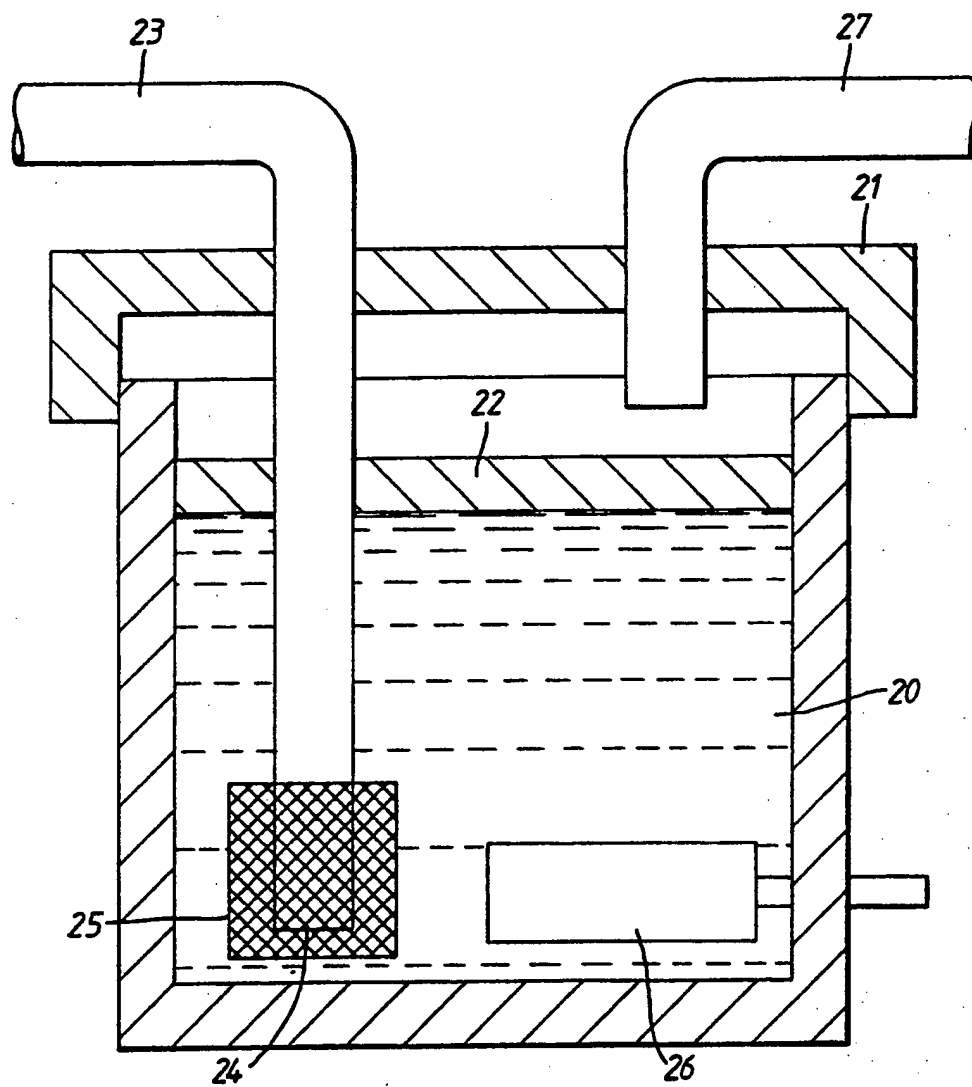


Fig. 2.

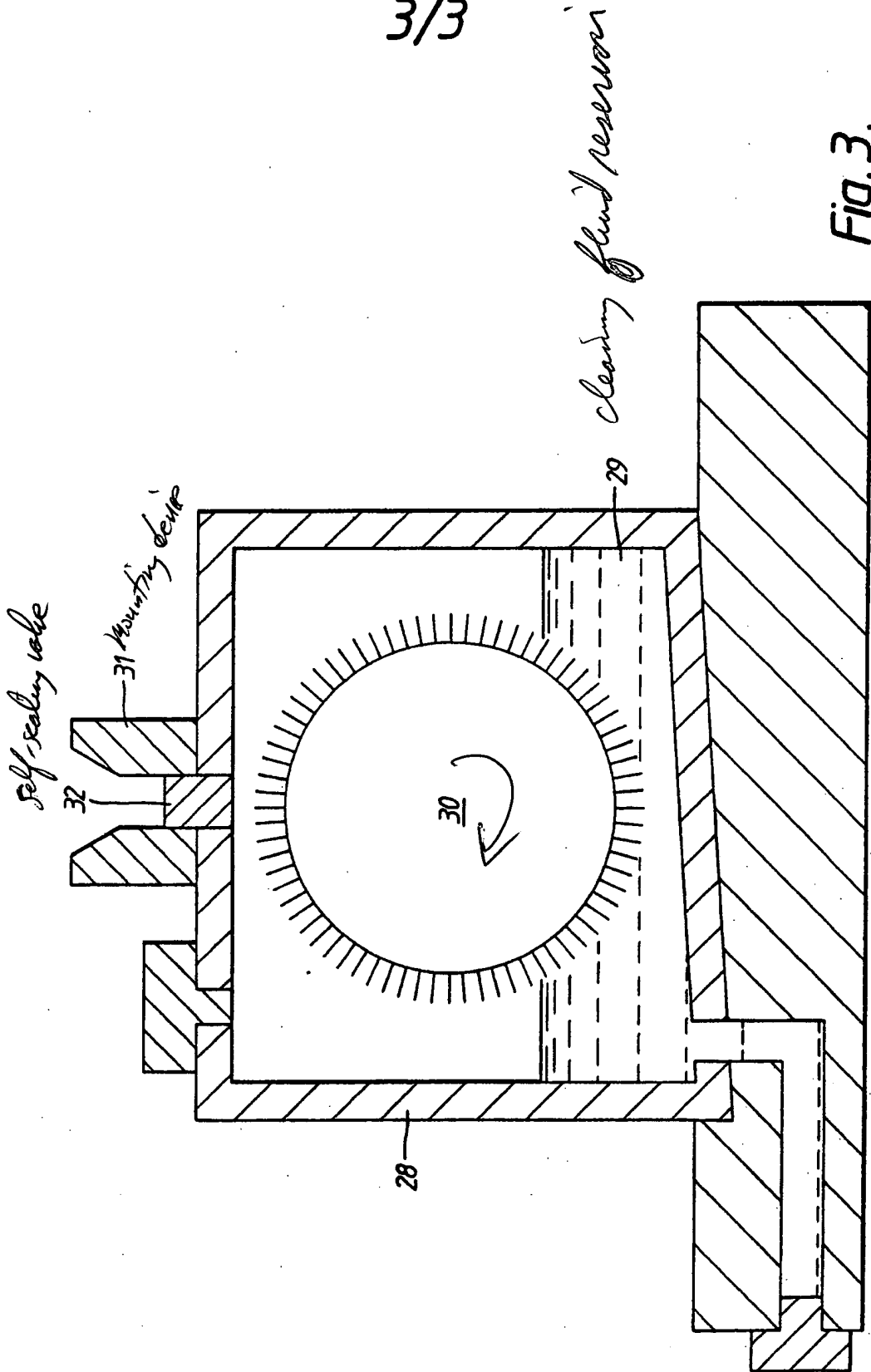


Fig. 3.

A painting device and a method of painting  
small details on an article

The invention relates to a painting device and a method of painting small details on an article

5        When painting an article such as a model railway locomotive several different painting methods are normally employed. For example, large areas of colour may be painted by spraying with an air brush and small details such as information panels, stock numbers,  
10 company names etc. may then be applied by stencilling or printing. Some finishing decorations such as various lines, hand rails etc. which are applied to raised mouldings on the surface of the article have until now however had to be applied by hand since they are too thin  
15 to be applied by stencil and cannot be printed because the surfaces to which they are applied are not flat.

It is an object of the invention to provide a device and a method capable of painting small details on an article, thereby enabling such details to be painted  
20 automatically.

According to the present invention there is provided a painting device for the painting of small details on an article, including a nozzle having a work-contacting surface, an inlet port adapted to receive a pressurised  
25 supply of paint, a paint conduit extending from the inlet port to the work-contacting surface of the nozzle, valve

means introduced in the conduit to control the flow of paint to the work-contacting surface and a valve actuator for operating the valve.

Because the nozzle is placed in contact with the surface to be painted, paint is applied directly to the article enabling very small details, such as very fine lines, to be painted. The device is capable of painting small details on surfaces which are not flat. The device may be guided automatically over the surface of the article and the valve may be actuated automatically, thereby enabling the small details to be painted automatically.

The work-contacting surface may be in the form of a groove, which may have a substantially semi-circular cross-section. The diameter of the groove may be less than 5 mm, and is preferably in the range of  $\frac{1}{2}$  to 2 mm. The groove may be located over a raised moulding on the surface of the article in use, thereby helping to guide the nozzle as it is moved over the surface of the article.

The nozzle may be removable, enabling it to be interchanged with another nozzle for painting thicker or thinner lines.

The valve may be located adjacent the nozzle, to give precise control over the flow of paint through the nozzle.

The actuator may be electrically operated.

The valve may be resiliently biased towards the

closed position.

The device may include means for attachment to a movable part of a machine, such as a robot arm.

At least part of the conduit may constitute a  
5 chamber for storing a supply of paint.

The device may include a pressurised paint supply connected to the inlet-port.

The present invention further provides an apparatus for cleaning the nozzle of a painting device including a  
10 reservoir for a supply of cleaning fluid, a rotatable brush arranged, in use, to be partially immersed in the fluid in the reservoir, and a mounting device for locating the nozzle in contact with the rotatable brush.

The cleaning apparatus enables dried or excess paint  
15 to be removed automatically from the nozzle.

The reservoir and the brush may be enclosed within a housing, and preferably the mounting device is located on the housing and is provided with a closure device for sealing the housing when the nozzle is withdrawn, thereby  
20 preventing the evaporation of cleaning fluid from the reservoir.

The present invention further provides an automated painting apparatus including a painting device and a cleaning apparatus, the painting device and the cleaning  
25 apparatus being substantially as described above.

The present invention yet further provides a method of painting small details on an article, in which a nozzle having a work-contacting surface is placed in

contact with the article to be painted and paint is supplied under pressure to the nozzle, the flow of paint to the nozzle being controlled by a valve.

The nozzle may be guided automatically over the  
5 surface to be painted by a movable part of a machine, such as a robot arm.

An embodiment of the invention will now be described with reference to the accompanying drawings, of which:

Figure 1 is a longitudinal cross-section through a  
10 painting device;

Figure 2 is a cross-section through a paint supply device; and

Figure 3 is a cross-section through a cleaning  
apparatus.

15 The painting device shown in Figure 1 includes a hollow cylindrical body 1 which is closed at both ends by a top wall 2 and a bottom wall 3. The interior of the body 1 forms a chamber 4 for paint, which is fed under pressure into the chamber through a swivel inlet port 5  
20 located on the cylindrical wall of the device.

An outlet port 6 extends through the bottom wall 3 of the device and provides a mounting for a removably-attached nozzle 7. The nozzle 7 has a cylindrical external shape and is provided towards its inner end with  
25 a screw thread which engages a matching thread on the interior surface of the outlet port 6. The nozzle 7 is hollow having a frusto-conical bore 8 which tapers, taperingly, from the inner end of the nozzle to its outer



nd, forming a passageway through which paint can flow from the chamber 4. At its outer end, the bore 8 intersects a groove 9 having a semi-circular cross-section which extends across a diameter of the outer end of the nozzle 7. The sides of the groove 9, which may have a diameter in the range  $\frac{1}{2}$  to 2 mm, form work-contacting surfaces which are shaped to fit over a raised moulding on the article to be painted and thereby help to guide the device as it is moved over the surface of the article. A number of interchangeable nozzles having grooves of different diameters and/or different shapes may be provided for painting mouldings of different sizes or shapes.

Seated within the inner end of the outlet port 6 is a valve 10 consisting of a rubber plug having a frusto-conical outer part 11 connected by a short cylindrical part 12 to a flange 13 of slightly larger diameter. The outer part 11 and the cylindrical part 12 are matched to the interior shape of the nozzle 7 and the outlet port 6 and, when the valve 10 is in the closed position, the flange 13 abuts the bottom wall 3 of the body 1, preventing paint flowing from the chamber 4 to the work-contacting surface (the groove 9) of the nozzle.

The valve 10 is attached to one end of a connecting rod 14 which extends through a partition wall 15 at the lower end of the chamber 4 and the top wall 2, its other end protruding beyond the end of the cylindrical body 1. A solenoid 16 mounted on the top wall 2 surrounds the

protruding end of the rod 14 and, when the solenoid is activated, the rod and the valve 10 are drawn upwards thereby opening the valve and allowing paint to flow from the chamber 4 to the nozzle 7. When the solenoid 16 is  
5 de-activated the valve 10 is returned to its closed position by a spring 17 compressed between the valve and the underside of the partition wall 15.

The partition wall 15 is provided with apertures 18 to allow paint to flow through the wall, and the chamber  
10 4, the apertures 18 and the outlet port 6 constitute a conduit through which paint can flow from the inlet port 5 to the work-contacting surfaces 9 of the nozzle 7. The partition wall 15 serves also to guide the lower end of the connecting rod 14 when the valve is actuated.

15 A mounting plate 19 is provided at the upper end of the device for attachment to a robot arm or other movable part of a painting machine.

A pressurised paint supply for the device described above is shown in Figure 2. The paint supply comprises a  
20 reservoir 20 for the paint having a cover 21 and a follower plate 22 which rests on the surface of the paint and falls with it as paint is expelled from the reservoir. An outlet conduit 23 extends through the cover 21 and the follower plate 22 and has an inlet port 24 near  
25 the bottom of the reservoir 20. The inlet port is surrounded by a filter 25. A rotating agitator 26 is provided towards the bottom of the reservoir.

In order to expel paint from the reservoir 20,

compressed air is supplied through a duct 27 to the space between the follower plate 22 and the cover 21. The compressed air biases the follower plate 22 downwards, urging paint to flow through the outlet conduit 23 to the inlet port 5 of the painting device.

Figure 3 shows a cleaning apparatus for removing dried or excess paint from the nozzle 7 of the painting device. The cleaning unit has a housing 28, the lower part of which constitutes a reservoir 29 for cleaning fluid. Situated within the housing 28 is a rotatable cylindrical brush 30, the lower part of which is immersed in the reservoir 29 of cleaning fluid. A mounting device 31 for the nozzle 7 of the painting device is provided in the upper part of the housing 28, and is positioned so that when the nozzle is engaged in the mounting device, the rotating brush 30 sweeps against the end of the nozzle to remove dried or excess paint. A self-sealing valve 32 is provided in the mounting device 31 to close the housing 28 when the nozzle 7 is removed, thereby preventing evaporation of the cleaning fluid.

In use, paint is supplied under pressure from the paint supply shown in Figure 2 to the painting device shown in Figure 1. The painting device is mounted on the end of a robot arm, and the arm is manipulated automatically to position the groove 9 of the nozzle 7 over a raised moulding on the surface of the article to be painted. The solenoid 16 is then activated, opening the valve 10 and allowing paint to flow through the nozzle 7,

and the device is guided automatically along the length of the moulding thereby painting a fine line on the article. The guiding of the device along the moulding is assisted by the engagement of the work-contacting surfaces of the groove 9 with the sides of the moulding. When the painting operation is completed, the valve 10 is closed automatically and the device is manipulated, by the robot arm, to the next painting operation. If necessary, the robot arm may be programmed to insert the nozzle 7 of the painting device into the cleaning unit (Figure 3) between operations to remove excess or dried paint. When lines of different thicknesses are to be painted, the nozzle 7 may be interchanged with another having a groove of a different diameter.

Claims:

1. A painting device for the painting of small details on an article, including a nozzle having a work-contacting surface, an inlet port adapted to receive a pressurised supply of paint, a paint conduit extending from the inlet port to the work-contacting surface of the nozzle, valve means interposed in the conduit to control the flow of paint to the work-contacting surface and a valve actuator for operating the valve.
2. A device according to claim 1, in which the work-contacting surface is in the form of a groove.
3. A device according to claim 2 in which the groove has a substantially semi-circular cross-section.
4. A device according to claim 3, in which the groove has a diameter of less than 5 mm.
5. A device according to any preceding claim, in which the nozzle is removable.
6. A device according to any preceding claim, in which the valve is located adjacent the nozzle.
7. A device according to any preceding claim, in which the actuator is electrically operated.
8. A device according to any preceding claim, in which the valve is resiliently biased towards the closed position.
9. A device according to any preceding claim, including means for attachment to a movable part of a machine .

10.           A device according to any preceding claim,  
in which at least part of the conduit constitutes a  
chamber for storing a supply of paint.
11.           A device according to any preceding claim,  
5 including a pressurised paint supply connected to the  
inlet port.
12.           A painting device for the painting of small  
details on an article, the device being substantially as  
described herein with reference to and as illustrated by  
10 the accompanying drawings.
13.           An apparatus for cleaning the nozzle of a  
painting device including a reservoir for a supply of  
cleaning fluid, a rotatable brush arranged, in use, to be  
partially immersed in the fluid in the reservoir, and a  
15 mounting device for locating the nozzle in contact with  
the rotatable brush.
14.           An apparatus according to claim 13, in which  
the reservoir and the brush are enclosed within a  
housing.
- 20 15.           An apparatus according to claim 14, in which  
the mounting device is located on the housing, and is  
provided with a closure device for sealing the housing  
when the nozzle is withdrawn.
16.           An apparatus for cleaning the nozzle of a  
25 painting device, the apparatus being substantially as  
herein described with reference to and as illustrated by  
the accompanying drawings.
17.           An automated painting apparatus including a

painting device according to any one of claims 1 to 12  
and a cleaning apparatus according to any one of  
claims 13 to 16.

18.           A method of painting small details on an  
5 article, in which a nozzle having a work-contacting  
surface is placed in contact with the article to be  
painted and paint is supplied under pressure to the  
nozzle, the flow of paint to the nozzle being controlled  
by a valve.

10 19.           A method according to claim 18, in which the  
nozzle is guided over the surface to be painted by a  
movable part of a machine.

20.           A method of painting small details on an  
article, the method being substantially as herein  
15 described with reference to and as illustrated by the  
accompanying drawings.